

## **REMARKS**

In response to the above-identified Final Office Action ("Action"), Applicant amends the application and seeks reconsideration thereof. In this response, Claims 3-8, 15-23 and 26-28 have been amended, no claims have been added and no claims have been cancelled. Accordingly, claims 1-10 and 14-32 are pending.

The instant invention is directed to a lithium secondary battery exhibiting high capacity, including a Cu-based alloy produced by a plating process into a foil shape and having both a good tensile strength and a thin thickness.

### **I. Amendments to the Claims**

In the attached Amendments to the Claims, Claims 3, 4, 19 and 26 have been amended to delete the language reciting the alloy comprises at least one of boron or cobalt. Claim 3 has been amended to recite the alloy comprises at least two of the recited group of materials and Claims 4, 19 and 26 have been amended to recite the alloy comprises at least three of the recited group of materials. The attached amendments are supported by the specification in, for example, Table 1. Dependent Claims 5-8, 15-18, 20-23 and 27-28 have been amended for consistency with the amendments to Claims 3, 4, 19 and 26. Claims 5, 20 and 27 have been amended to clarify that one of the three materials may be boron or cobalt. Thus, the amendments do not add new matter. In view of the foregoing, Applicant respectfully requests consideration and entry of the attached Amendments to the Claims.

## **II. Claims Rejected Under 35 U.S.C. §112, first paragraph**

In the outstanding Action, the Examiner rejects claims 3-10 and 14-31 on the basis they fail to comply with the written description requirement. In particular the Examiner alleges the language reciting the "Cu-alloy comprising at least boron or cobalt and further comprising" at least one or two of the remaining components is not supported by the specification in a way to reasonably convey the inventor had possession of the claimed invention and further the specification does not enable one of skill in the art to make or use the invention. As discussed above, Applicant respectfully amends Claims 3, 4, 19 and 26 to delete this language. Applicant respectfully submits the claims as amended and their dependent claims are in compliance with 35 U.S.C. §112, first paragraph. In view of the foregoing, Applicant respectfully requests withdrawal of the rejection of Claims 3-10 and 14-31 on this basis.

## **III. Claims Rejected Under 35 U.S.C. § 103(a)**

Claims 4-6, 26, 27, 29, 31 and 32 are finally rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,368,958 issued to Hirai et. al. ("Hirai"). Applicant respectfully traverses the rejection for at least the following reasons.

In regard to independent Claim 4, Applicant respectfully submits Hirai fails to teach or suggest a lithium secondary battery comprising at least the elements of a negative current collector made of "a copper-based alloy with a thickness of 20  $\mu\text{m}$  or less and the copper-based alloy comprises at least three materials selected from the group consisting of boron in an amount of 0.0005 to 5.0 wt% of copper, cobalt in an

amount of 0.01 to 2.0 wt% of copper, nickel in an amount of 0.8 to 4 wt% of copper, titanium in an amount of 0.2 to 4 wt% of copper, magnesium in an amount of 0.05 to 0.6 wt% of copper, tin in an amount of 0.1 to 2.0 wt% of copper, zinc in an amount of 0.0005 to 0.5 wt% of copper, chromium in an amount of 0.0005 to 0.5 wt% of copper, manganese in an amount of 0.1 to 1.0 wt% of copper, silicon in an amount of 0.1 to 0.5 wt% of copper, iron in an amount of 0.01 to 2.0 wt%, vanadium in an amount of 0.0005 to 0.5 wt% of copper, aluminum in an amount of 0.005 to 0.5 wt% of copper, zirconium in an amount of 0.0005 to 0.5 wt% of copper, niobium in an amount of 0.0005 to 0.5 wt% of copper, phosphorous in an amount of 0.02 to 0.16 wt% of copper, bismuth in an amount of 0.0005 to 0.5 wt% of copper, lead in an amount of 0.0005 to 0.5 wt% of copper and silver in an amount of 0.0005 to 0.5 wt% of copper, and further comprises a copper-based material selected from the group consisting of copper, copper/nickel, copper/titanium, and copper/nickel/titanium, wherein the copper-based alloy is produced by a plating process into a foil shape” as recited in amended Claim 4.

In regard to independent Claim 19, Applicant respectfully submits, Hirai fails to teach or suggest a method of making a lithium secondary battery comprising at least the elements of a negative current collector made of a “Cu-based alloy with a thickness of 20  $\mu\text{m}$  or less, and the Cu-based alloy including at least three materials selected from the group consisting of boron in an amount of 0.0005 to 5.0 wt% of copper, cobalt in an amount of 0.01 to 2.0 wt% of copper, nickel in an amount of 0.8 to 4 wt% of copper, titanium in an amount of 0.2 to 4 wt% of copper, magnesium in an amount of 0.05 to 0.6 wt% of copper, tin in an amount of 0.1 to 2.0 wt% of copper, zinc in an amount of 0.0005

to 0.5 wt% of copper, chromium in an amount of 0.0005 to 0.5 wt% of copper, manganese in an amount of 0.1 to 1.0 wt% of copper, silicon in an amount of 0.1 to 0.5 wt% of copper, iron in an amount of 0.01 to 2.0 wt%, vanadium in an amount of 0.0005 to 0.5 wt% of copper, aluminum in an amount of 0.005 to 0.5 wt% of copper, zirconium in an amount of 0.0005 to 0.5 wt% of copper, niobium in an amount of 0.0005 to 0.5 wt% of copper, phosphorous in an amount of 0.02 to 0.16 wt% of copper, bismuth in an amount of 0.0005 to 0.5 wt% of copper, lead in an amount of 0.0005 to 0.5 wt% of copper and silver in an amount of 0.0005 to 0.5 wt% of copper, wherein the copper-based alloy is produced by a plating process into a foil shape” as recited in amended Claim 19.

In regard to independent Claim 26, Applicant respectfully submits, Hirai fails to teach or suggest a lithium secondary battery comprising at least the elements of a negative current collector is made of “a copper-based alloy foil with a thickness of 20  $\mu\text{m}$  or less, and the copper-based alloy foil includes at least three materials selected from the group consisting of boron in an amount of 0.0005 to 5.0 wt% of copper, cobalt in an amount of 0.01 to 2.0 wt% of copper, nickel in an amount of 0.8 to 4 wt% of copper, titanium in an amount of 0.2 to 4 wt% of copper, magnesium in an amount of 0.05 to 0.6 wt% of copper, manganese in an amount of 0.1 to 1.0 wt% of copper, and zinc in an amount of 0.0005 to 0.5 wt%” as recited in amended Claim 26.

In regard to independent Claim 32, Applicant respectfully submits, Hirai fails to teach or suggest a lithium secondary battery comprising at least the elements of “a

copper-based alloy foil with a thickness of 20  $\mu\text{m}$  or less and the copper-based alloy including at least one material selected from the group consisting of magnesium in an amount of 0.05 to 0.6 wt% of copper, boron in an amount of 0.0005 to 5.0 wt% of copper, cobalt in an amount of 0.01 to 2.0 wt%, vanadium in an amount of 0.0005 to 0.5 wt% of copper, niobium in an amount of 0.0005 to 0.5 wt% of copper, bismuth in an amount of 0.0005 to 0.5 wt% of copper, tin in an amount of 0.1 to 2.0 wt% of copper, chromium in an amount of 0.0005 to 0.5 wt% of copper and manganese in an amount of 0.1 to 1.0 wt% of copper and further comprises a copper-based material selected from the group consisting of copper, copper/nickel, copper/titanium, and copper/nickel/titanium, wherein the copper-based alloy is produced by a plating process into a foil shape” as recited in Claim 32.

The Examiner alleges Hirai teaches an alloy foil comprising an alloy having at least two materials selected from the group consisting of Cr, Cu, Au, Ag, Al, In, Fe, Pb, Mn, Zn, Cd, Tl, Co, Ni and Sn in column 4, lines 8-17 of Hirai. The Examiner further alleges “Hirai teaches that copper may be alloyed with materials such as Co, Ni, Sn, Zn, Cr, Mn, Fe, Al, Pb or Ag” and on this basis concludes it would be obvious to one of ordinary skill in the art to arrive at Applicant’s claimed combination. See Action, page 4. In addition, the Examiner alleges the limitation of “produced by a plating process” is obvious in the absence of unexpected results. Applicant respectfully disagrees with the Examiner’s characterization of Hirai and further submits unexpected results are achieved by using the recited “plating process.”

In column 4, lines 8-17 cited by the Examiner, Hirai states the following:

“[t]he metal, alloy or composite foil or mesh can be fabricated for example from either Cr, Cu, Au, Ag, Al, In, Fe, Pb, Mn, Zn, Cd, Ti, Co, Ni or Sn as the metal or an alloy whose main component is Cr, Cu, Au, Ag, Al, In, Fe, Pb, Mn, Cd, Ti, Co, Ni or Sn or a composite whose main component is Cr, Cu, Au, Ag, Al, In, Fe, Pb, Mn, Cd, Ti, Co, Ni or Sn” (emphasis added).

Hirai’s use of the alternative term “or” in the above description limits the selection of the material for either the metal, alloy or composite to one of “Cr, Cu, Au, Ag, Al, In, Fe, Pb, Mn, Zn, Cd, Ti, Co, Ni or Sn”, not at least two materials as stated by the Examiner. Although, Hirai teaches Cu may be selected as the main component of the alloy, it does not teach or suggest the selection of a second material from the list to be alloyed with the Cu alloy as suggested by the Examiner. Thus, the Examiner has not set forth a portion of Hirai teaching Applicant’s claimed copper based alloy comprising at least three materials selected from the recited group of Claims 4, 19, 26 and the copper based alloy of Claim 32 comprising a copper-based material selected from the group consisting of copper, copper/nickel, copper/titanium, and copper/nickel/titanium within Hirai.

Hirai further fails to teach or suggest the weight percentages recited in Claims 4, 19, 26 and 32. The Examiner alleges the ranges are not inventive because the general conditions of the claims are disclosed by the prior art. See Action, page 4. Applicant respectfully submits, the general conditions of the claims are not disclosed by the prior art. As discussed above, Applicant’s claims are directed to a copper-based alloy comprising at least three additional materials selected from the recited group. In

contrast, Hirai teaches a metal, alloy or composite having one main component and does not teach the addition of another. Accordingly, Applicant's claimed ranges are inventive over the prior art.

Additionally, in connection with the unexpected results of the present invention, the recited alloy prepared by adding cobalt to copper, has a uniform composition and resultantly the tensile strength of the alloy increases. Using the claimed plating process renders the composition of the alloy uniform. Applicant respectfully directs the Examiner's attention to the test results reproduced below for an alloy which is prepared by adding cobalt to copper using the electrolytic plating process in Table 1 of the instant specification (See Application, page 5), reproduced below for the Examiner's easy comparison. The test method was performed according to the same method as in the Examples of the present invention.

	Composition	Tensile strength [N/mm <sup>2</sup> ]
Example 1	Ni: 1.8 wt%, Ti: 1.1 wt%, Cu: balance	560
Example 2	Ni: 2.0 wt%, Ti: 0.9 wt%, Mg: 0.13 wt%, Cu: balance	620
Example 3	Ni: 2.0 wt%, Ti: 1.1 wt%, Mg: 0.29wt%, Mn: 0.52 wt%, Cu: balance	620
Example 4	Ni: 1.5 wt%, Ti: 0.9 wt%, Mg: 0.26 wt%, Zn: 0.20 wt%, Cu: balance	630
Comp. Ex. 1	Cu: at least 99.9 wt%	420
Comp. Ex. 2	Cu: at least 99.9 wt%	340
New Ex. 1	Co: 1.8 wt%, Ti: 1.1 wt%, Cu: balance	600
New Ex. 2	Co: 2.0 wt%, Ti: 0.9 wt%, Mg: 0.13 wt%, Cu: balance	650
New Ex. 3	Co: 1.5 wt%, Ti: 0.9 wt%, Mg: 0.26 wt%, Zn: 0.20 wt%, Cu: balance	720

Thus, for at least the foregoing reasons, Hirai fails to teach or suggest each and every element of Claims 4, 19, 26 and 32. Since each element of Claims 4, 19, 26 and 32 are not taught or suggested by Hirai, a *prima facie* case of obviousness may not be established. For at least the foregoing reasons, Applicant respectfully requests withdrawal of the rejection of Claims 4, 19, 26 and 32 under 35 U.S.C. §103(a).

In regard to Claims 5-6, 27 and 31, Claims 5-6 depend from independent Claim 4 and Claims 27 and 31 depend from Claim 26 and incorporate the limitations thereof. Thus, at least for the reasons mentioned in regard to Claims 4 and 26, these claims are not obvious over Hirai. Accordingly, reconsideration and withdrawal of the rejection of Claims 5-6, 27 and 31 under 35 U.S.C. § 103(a) is respectfully requested.



## CONCLUSION

In view of the foregoing, it is believed that all claims now pending patentably define the subject invention over the prior art of record, and are in condition for allowance and such action is earnestly solicited at the earliest possible date. If the Examiner believes that a telephone conference would be useful in moving the application forward to allowance, the Examiner is encouraged to contact the undersigned at (310) 207-3800.

Respectfully submitted,

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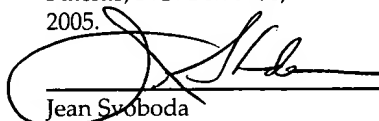
Dated: 11/3, 2005

  
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### CERTIFICATE OF FACSIMILE:

I hereby certify that this correspondence is being transmitted via facsimile No. (703)273-8300 to: Mail Stop AF, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on November 3, 2005.

  
Jean Svoboda

November 3, 2005